

Claims

- [c1] 1.A method for continuously producing an alkyl aryl ether comprising:
reacting a dialkyl carbonate and an aromatic alcohol in the presence of a transesterification catalyst in a first reactive distillation column;
recovering from said first reactive distillation column a stream comprising said dialkyl carbonate, said alkyl alcohol and said alkyl aryl ether;
separating said alkyl aryl ether in said stream from said dialkyl carbonate and alkyl alcohol in a rectification column; and
recovering from said rectification column a product stream comprising substantially pure said alkyl aryl ether.
- [c2] 2.The method according to claim 1 wherein said stream is drawn from the top of said first reactive distillation column.
- [c3] 3.The method according to claim 1 wherein said stream is drawn from the side of said first reactive distillation column.
- [c4] 4.The method according to claim 1 wherein said first reactive distillation column is maintained at a temperature of about 100 to about 300 °C.
- [c5] 5.The method according to claim 4 wherein said first reactive distillation column is maintained at a temperature of about 140 to about 220 °C.

- [c6] 6.The method according to claim 1 wherein said first reactive distillation column is maintained at a pressure of about 5,000 Pascal to about 2,000,000 Pascal.
- [c7] 7.The method according to claim 6 wherein said first reactive distillation column is maintained at a pressure of about 300,000 to about 700,000 Pascal.
- [c8] 8.The method according to claim 1 wherein said rectification column is maintained at a temperature of about 50 to about 150 °C.
- [c9] 9.The method according to claim 1 wherein said rectification column is maintained at a pressure of about 50,000 Pascal to about 200,000 Pascal.
- [c10] 10.The method according to claim 1 wherein said product stream comprises at least about 95% said alkyl aryl ether by weight.
- [c11] 11.The method according to claim 1 wherein said product stream comprises at least about 99% of said alkyl aryl ether by weight.
- [c12] 12.A method for continuously producing a diaryl carbonate and an alkyl aryl ether comprising:
reacting a dialkyl carbonate and an aromatic alcohol in the presence of a transesterification catalyst in a first reactive

distillation column;

recovering from said first reactive distillation column a first top stream comprising said dialkyl carbonate, said alkyl alcohol and said alkyl aryl ether;

splitting said first top stream into a first split stream and a second split stream;

recovering from said first reactive distillation column a first bottom stream comprising said alkyl aryl carbonate, dialkyl carbonate, aromatic alcohol, alkyl aryl ether and transesterification catalyst;

introducing said first bottom stream into a second reactive distillation column;

recovering from said second reactive distillation column a second bottom stream comprising said diaryl carbonate, alkyl aryl carbonate, dialkyl carbonate, aromatic alcohol and transesterification catalyst;

introducing said second split stream into a second rectification column, separating said dialkyl carbonate and said alkyl alcohol from said alkyl aryl ether, and recycling said dialkyl carbonate and said alkyl alcohol to a first rectification column;

introducing said first split stream into said first rectification column;

recovering from said first rectification column a second top stream comprising said dialkyl carbonate and alkyl alcohol, and a third bottom stream comprising said dialkyl carbonate,

and recycling part of said third bottom stream to said first reactive distillation column;

recovering a first product stream from bottom of said second rectification column comprising substantially pure said alkyl aryl ether;

introducing said second bottom stream into a third reactive distillation column;

recovering a second product stream comprising diaryl carbonate produced from the bottom of said third reactive distillation column and a third top stream comprising aromatic alcohol, dialkyl carbonate and alkyl aryl ether; and

recycling said third top stream to said first reactive distillation column.

[c13] 13.The method according to claim 12 wherein said second reactive distillation column is maintained at a temperature of about 50 to about 300 °C.

[c14] 14.The method according to claim 13 wherein said second reactive distillation column is maintained at a temperature of about 100 to about 250 °C.

[c15] 15.The method according to claim 12 wherein said second reactive distillation column is maintained at a pressure of about 5,000 Pascal to about 1,000,000 Pascal.

[c16] 16.The method according to claim 15 wherein said second

reactive distillation column is maintained at a pressure of about 100,000 to about 300,000 Pascal.

[c17] 17.The method according to claim 12 wherein said third reactive distillation column is maintained at a temperature of about 100 to about 300 °C.

[c18] 18.The method according to claim 17 wherein said third reactive distillation column is maintained at a temperature of about 140 to about 200 °C

[c19] 19.The method according to claim 12 wherein said third reactive distillation column is maintained at a pressure of about 1,000 Pascal to about 300,000 Pascal.

[c20] 20.The method according to claim 19 wherein said third reactive distillation column is maintained at a pressure of about 10,000 to about 40,000 Pascal.

[c21] 21.The method according to claim 12 wherein said second reactive distillation column is maintained at a pressure lower than the pressure in said first reactive distillation column.

[c22] 22.The method according to claim 12 wherein the first top stream is introduced to a partial condenser.

[c23] 23.A method for continuously producing an alkyl aryl ether comprising:
reacting a dialkyl carbonate and an aromatic alcohol in the

presence of a transesterification catalyst in a first reactive distillation column;

recovering from said first reactive distillation column a side stream comprising said dialkyl carbonate, said alkyl alcohol and said alkyl aryl ether;

separating said alkyl aryl ether in said side stream from said dialkyl carbonate and alkyl alcohol in a rectification column;

and

recovering from bottom of said rectification column a product stream comprising substantially pure said alkyl aryl ether.

- [c24] 24. An apparatus for continuous production of a substantially pure alkyl aryl ether comprising first and second reactive distillation columns, and first and second rectification columns and a plurality of streams for transporting reactant and product streams, wherein:
- said first reactive distillation column is connected to input streams, and to first, second and third transfer streams, said first transfer stream running from the top of said first reactive distillation column to said first rectification column; said second transfer stream running from the side of said first reactive distillation column to said second rectification column and said third transfer stream running from the bottom of said first reactive distillation column to said second reactive distillation column; and

said second rectification column is connected to a product stream running from the bottom for recovering alkyl aryl ether and a recycle stream running from the top to said first rectification column.

[c25] 25. An apparatus for continuous production of diaryl carbonate and alkyl aryl ether comprising first, second and third reactive distillation columns, first and second rectification column, a splitter and a plurality of streams for transporting reactant and product streams, wherein:

said first reactive distillation column is connected to input streams for the introduction of reactants, and to first and second transfer streams, said first transfer stream running from the top of said first reactive distillation column to said splitter; said second transfer stream running from the bottom of said first reactive distillation column to said second reactive distillation column;

said splitter is connected to first and second split streams, said first split stream running from said splitter to said first rectification column and said second split stream running from said splitter to said second rectification column;

second reactive distillation column is connected to third and fourth transfer streams, said third transfer stream running from the top of said second reactive distillation column to the bottom of said first rectification column, and said fourth

transfer stream running from the bottom of said second reactive distillation column to said third reactive distillation column;

said third reactive distillation column is connected to a second product stream for providing diaryl carbonate product from the bottom of said third reactive distillation column and a first recycle stream running from the top of said third reactive distillation column to said first reactive distillation column;

said first rectification column is connected to a third product stream for providing dialkyl carbonate/alkyl alcohol mixture from the top of said first rectification column, and a second recycle stream running from the bottom of said first rectification column to the bottom of said first reactive distillation column; and

said second rectification column is connected to a first product stream for recovering said alkyl aryl ether from the bottom of said second rectification column and a third recycle stream running from the top of said second rectification column to the middle of said first rectification column.

- [c26] 26. A method of making polycarbonate and substantially pure alkyl aryl ether, said method comprises reacting a bisphenol with a diaryl carbonate wherein said diaryl carbonate and said alkyl aryl ether is prepared by:
- reacting a dialkyl carbonate and an aromatic alcohol in the

presence of a transesterification catalyst in a first reactive distillation column;

recovering from said first reactive distillation column a stream comprising said dialkyl carbonate, said alkyl alcohol and said alkyl aryl ether;

separating said alkyl aryl ether in said stream from said dialkyl carbonate and alkyl alcohol in a rectification column; and
recovering from said rectification column a product stream comprising substantially pure said alkyl aryl ether.